

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application.

Please amend claims 6, 21 and 22.

Claim 1. (Original): A magnetoresistance sensor structure comprising:  
a magnetoresistance sensor having a sensor surface plane and comprising a free layer;  
an upper antiferromagnetic layer overlying at least a portion of the free layer; and  
an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer.

Claim 2.(Original): The magnetoresistance sensor structure of claim 1, wherein the upper antiferromagnetic layer is PtMn and the upper ferromagnetic layer is CoFe.

Claim 3.(Original): The magnetoresistance sensor structure of claim 1, wherein the magnetoresistance sensor is a giant magnetoresistance sensor.

Claim 4.(Original): The magnetoresistance sensor structure of claim 1, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including  
a cap layer overlying a second portion of the free layer.

Claim 5.(Original): The magnetoresistance sensor structure of claim 1, wherein the magnetoresistance sensor is a tunnel magnetoresistance sensor.

Claim 6.(Currently amended): A ~~magnetoresistance~~ magnetoresistance sensor structure comprising:

- a magnetoresistance sensor having a sensor surface plane and comprising a free layer;
- an upper antiferromagnetic layer overlying substantially all the free layer;
- an upper ferromagnetic layer overlying substantially all the free layer and contacting the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer; and
- a cap layer overlying the upper ferromagnetic layer.

Claim 7.(Original): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

- a lower antiferromagnetic layer, and
- a free layer overlying the lower antiferromagnetic layer;
- an upper antiferromagnetic layer overlying at least a portion of the free layer; and
- an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer.

Claim 8.(Previously amended): The magnetoresistance sensor structure of claim 7, wherein the lower antiferromagnetic layer and the upper antiferromagnetic layer are made of the same material.

Claim 9.(Original): The magnetoresistance sensor structure of claim 7, wherein the lower antiferromagnetic layer and the upper antiferromagnetic layer are both PtMn.

Claim 10.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper ferromagnetic layer is CoFe.

Claim 11.(Original): The magnetoresistance sensor structure of claim 7, wherein the magnetoresistance sensor is a giant magnetoresistance sensor.

Claim 12.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer.

Claim 13.(Previously amended): A magnetoresistance sensor structure comprising:  
a magnetoresistance sensor having a sensor surface plane and comprising:

a lower antiferromagnetic layer, and

a free layer overlying the lower antiferromagnetic layer;

an upper antiferromagnetic layer overlying a first portion of the free layer that is less than all of the free layer;

an upper ferromagnetic layer overlying a first portion of the free layer that is less than all of the free layer and contacting the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer; and

a cap layer overlying a second portion of the free layer.

Claim 14.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including a lead layer overlying the upper ferromagnetic layer.

Claim 15.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including a lead layer overlying the upper ferromagnetic layer; and a cap layer overlying a second portion of the free layer.

Claim 16.(Original): The magnetoresistance sensor structure of claim 7, wherein the magnetoresistance sensor is a tunnel magnetoresistance sensor.

Claim 17.(Previously amended): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

- a lower antiferromagnetic layer, and
- a free layer overlying the lower antiferromagnetic layer;
- an upper antiferromagnetic layer overlying substantially all the free layer;
- an upper ferromagnetic layer overlying substantially all the free layer and contacting the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer; and
- a cap layer overlying the upper ferromagnetic layer.

Claim 18.(Original): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane, a transverse direction lying in the sensor surface plane, and a longitudinal direction lying perpendicular to the transverse direction and in the sensor surface plane, the magnetoresistance sensor comprising:

- a transverse biasing stack including a lower antiferromagnetic layer, and
- a free layer overlying the transverse biasing stack; and
- a longitudinal biasing stack overlying the magnetoresistance sensor, the longitudinal biasing stack comprising:
  - an upper antiferromagnetic layer, and

an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the magnetoresistance sensor.

Claim 19.(Original): The magnetoresistance sensor structure of claim 18, wherein the magnetoresistance sensor is a giant magnetoresistance sensor.

Claim 20.(Original): The magnetoresistance sensor structure of claim 18, wherein the magnetoresistance sensor is a tunnel magnetoresistance sensor.

Claim 21.(Currently amended): A magnetoresistance sensor structure comprising:  
a magnetoresistance sensor having a sensor surface plane and comprising:  
a free layer;  
an upper antiferromagnetic layer overlying at least a portion of the free layer in a plane parallel to the sensor surface plane; and  
an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer in a plane parallel to the sensor surface plane.

Claim 22.(Currently amended): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

- a lower antiferromagnetic layer;

- a free layer overlying the lower antiferromagnetic layer;

- an upper antiferromagnetic layer overlying at least a portion of the free layer in a plane parallel to the sensor surface plane; and

- an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer in a plane parallel to the surface plane.

Claim 23.(Previously presented): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane, a transverse direction lying in the sensor surface plane, and a longitudinal direction lying perpendicular to the transverse direction and in the sensor surface plane, the magnetoresistance sensor comprising:

- a transverse biasing stack including a lower antiferromagnetic layer;

- a free layer overlying the transverse biasing stack; and

- a longitudinal biasing stack overlying the magnetoresistance sensor, the longitudinal biasing stack comprising:

  - an upper antiferromagnetic layer; and

  - an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies

between the upper ferromagnetic layer and the magnetoresistance sensor  
in a plane parallel to the sensor surface plane.